Notes on Sea Turtle Rookeries on the Arafura Sea Islands of Arnhem Land, Northern Territory

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Abstract

Selected islands of the southern Arafura sea were surveyed for sea turtle nesting during June - July 1989. The numbers of Olive Ridley Turtles *Lepidochelys olivacea* and Flatback Turtles *Natator depressus* nesting on Marchinbar, Cape Wessel, NW Crocodile, Grant and New Year Islands are presented. Sand temperatures at nest depth on nesting beaches varied from 26.8°C on New Year Island to 30.1°C on NW Crocodile Island. Scale counts of hatchlings, egg dimensions and clutch information are presented for each species. Careful consideration of the impact of pollution and future development in the area is urged.

Introduction

Previous reports of sea turtle nesting in the Northern Territory are sporadic and in part based on anecdotal evidence. The islands to the west of Darwin (Indian, Bare Sand, Quail and West Peron) are important nesting areas for the Flatback Turtle *Natator depressus* (Fry 1913; Pritchard 1977) as are the Sir Edward Pellew Islands in the south western Gulf of Carpentaria (Cogger 1968 a, b). The sandy inlets and islands of Cobourg Peninsula and elsewhere off the Arnhem Land coast support breeding populations of Flatback and Olive Ridley Turtle *Lepidochelys olivacea* (Cogger & Lindner 1969). Large numbers of the Green Turtle *Chelonia mydas* occur in the western Gulf of Carpentaria (Limpus & Reed 1985; Marsh *et al.* 1986).

Further observations on the sea turtles nesting on the islands off the north coast of Arnhem Land are reported here. The islands were selected on the basis of reports of turtle tracks by Coastwatch Air Surveillance aircraft and by nomination by local members of Arnhem Land communities as turtle nesting sites.

Study Area

The islands investigated extend from Cape Wessel in north east Arnhem Land to New Year Island, east of Cobourg Peninsula and included Cape Wessel, Two Island and Jensen Bays on Marchinbar Island, North West Crocodile and Grant Islands (Fig. 1). The region experiences semi-diurnal tides with a mean spring tidal range of 2.8 m and a mean neap range of 1.4 m. The survey was conducted from 29 June to 4 July 1989, during a period of the waning moon (new moon on 3 July). The islands displayed a variety of sands ranging from white silica beaches (Marchinbar I), a mixture of iron, silica and calcium carbonate (NW Crocodile I) and pure calcium carbonate (New Year I). All were vegetated with typical strand vegetation including *Pemphis acidula*, grasses and herbs.

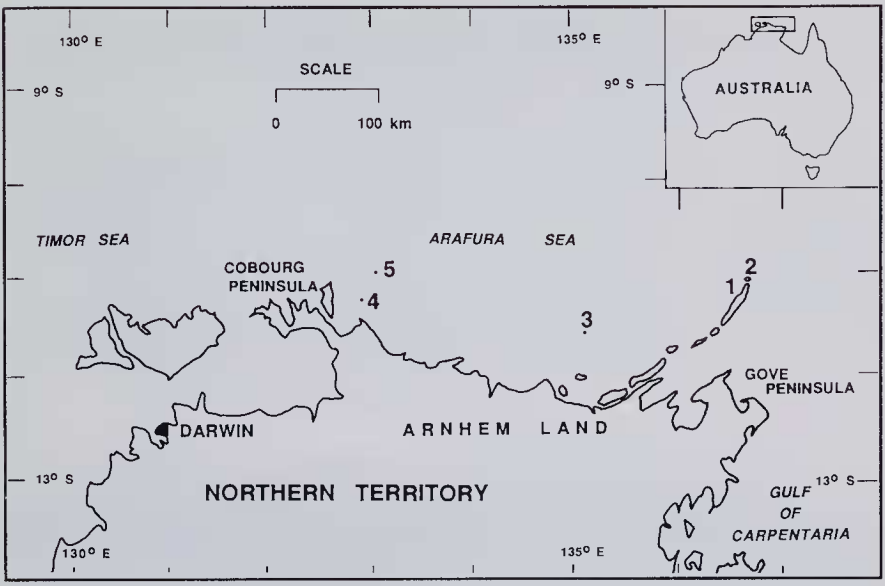

FIGURE 1 *The islands of the Arafura Sea that were surveyed for sea turtle nesting activity in June and July 1989. (1) Marchinbar Island, (2) Cape Wessel, (3) NW Crocodile Island, (4) Grant Island, and (5) New Year Island.*

Methods

Each locality was visited for at least several hours during which as much of the island as possible was inspected for turtle tracks and nests. The width and symmetry of tracks were used to determine the species concerned. Ridley tracks had a maximum width of 75 cm and displayed an asymmetric pattern produced from an alternating gait (Type B, Limpus 1971). Flatback tracks were wider (96 cm), and symmetric in pattern (Type A, Limpus 1971; Limpus *et al.* 1988).

Recently laid nests were opened and the clutch counted. A sample of ten eggs, where possible, from each clutch was weighed (Pesola spring balance ± 0.1 g) and measured (Vernier callipers, ±0.05 mm). Sand temperatures were measured with a mercury-in-glass thermometer (±0.2°C). Temperature readings were taken from the base of the egg chamber and in holes dug to a depth of 50 cm in the beach near the turtle nests. The methods and terminology follow those used by Limpus *et al.* (1983a). The number of nests with visible tracks were counted to give an indication of the nesting activity over the previous month. The number of hatched nests was used as an indication of nesting activity 45 to 55 days prior to the survey (Cogger & Lindner 1969).

TABLE 1 *The number of nests (fresh / hatched) of Ridley and Flatback Turtles at each locality visited during the survey. Sand temperatures measured at nest depth (mean ± standard deviation, sample size in parentheses).*

Locality	*Ridley*	*Flatback*	*Sand Temp°C*
Jensen Bay	1/1	0/0	28.5 ± -- (1)
Cape Wessel	3/4	0/0	27.1 ± 1.0 (5)
N.W. Crocodile	14/10	22/4	30.1 ± 0.7 (4)
Grant	32/0	0/2	28.0 ± 1.4 (2)
New Year	38/4	0/0	26.8 ± 1.1 (2)

Results

1. *Jensen Bay, Marchinbar Island*

In Jensen Bay on the west coast of Marchinbar Island a single recent Ridley nest was located (Table 1). A visit to Two Island Bay, four kilometres to the north of Jensen Bay, revealed no evidence of sea turtle nesting in the last month. However, members of the Jensen Bay outstation stated that nesting did occur there.

2. *Cape Wessel*

There was no sign of nesting activity on the western beach, but four turtle nests had recently hatched on the eastern side. Ridley hatchlings were collected from one nest. The carapace, plastron, head and limbs of the hatchlings were generally black in colour with only the distal edge of the marginal and supracaudal scales tipped with white. Three low longitudinal ridges were present along the carapace. The remaining hatched nests had been opened by goannas (*Varanus* sp), but the eggs were of a size which was consistent with those of a Ridley. All nests were below the vegetation at the base of the dune.

Three recently laid nests with Ridley-like tracks were located on the south-eastern part of the island. One clutch of 88 contained embryos which were approximately 20 mm long [stage 23 of Miller (1985)], the diameter and mass of the eggs were not recorded because of errors associated with water absorption. A second nest contained 138 eggs but the third had been opened by goannas leaving only three eggs intact.

Other species of turtle may nest on the island but from the width of the tracks it appeared that only the Ridley nested at the time of my survey. Tracks in coral shingle on the north west side of the island indicated possible nests but none were located. The remains of turtle egg shells beside a deserted aboriginal camp suggested that a species having an egg much larger than that of the Ridley had been consumed there at some time in the past.

While sailing to the Crocodile Islands, the vessel passed an adult Ridley basking at the surface (15:00 hr; water temperature, 26.0°C). At that locality (11° 14'S., 136°22'E.) the depth was 30 to 60 m.

3. *North West Crocodile Island*

North West Crocodile Island consisted of ironstone and iron stained sand. Dunes to a height of 10 m were located at the south-eastern end of the island. The remainder of the coast comprised sand and beach rock. There was no evidence of goannas and the island supported a colony of Crested Terns *Sterna bergii.*

Ridley and Flatback tracks were common on the island. As surface sand temperatures (55°C+) during the survey may have been lethal to embryos, freshly laid nests were not opened. On a 1 km sample of the beach at the north-western point of the island, 14 Ridley and 22 Flatback nests were counted with obvious recent tracks. On the same beach, 10 Ridley and 4 Flatback nests had hatched in recent days. As approximately 25 % of the available nesting beach was thoroughly surveyed, the number of recent nests on the island may be four times those that were recorded. The hatched nest data indicates that, in contrast to July, Ridley nestings in mid-April outnumbered those of the Flatback.

PLATE 1 Adult Flatback Turtle *Natator depressus* at Fog Bay, west of Darwin (M. Guinea)

TABLE 2 *Nest and egg data for Ridley and Flatback turtles from the islands of the southern Arafura Sea. Sand depth measured to the top and to the bottom of the egg chamber. Hatching success of the nests given as percentage of eggs that produced live hatchlings. Values indicate mean ± standard deviation; sample size in parenthesis.*

	Ridley	*Flatback*
Clutch size	101.5 ± 19.1 (7)	45.5 ± 2.1 (2)
Egg diameter (mm)	36.7 ± 1.5 (23)	–
Egg mass (g)	26.1 ± 2.9 (23)	–
Nest depth (cm)		
Top	29.3 ± 4.0 (7)	29.5 ± 6.4 (2)
Bottom	49.1 ± 3.7 (7)	52.0 ± 7.1 (2)
Hatching success (%)	81.0 ± 6.6 (4)	98.9 ± 1.5 (2)

TABLE 3 *Scale counts, carapace dimensions and mass of hatchlings of Ridley and Flatback turtles from Cape Wessel and N.W. Crocodile Island. Scale counts indicate number of scales on left/right sides of body, followed in parentheses by number of turtles with that count. Carapace dimensions indicate mean (± standard deviation) of the Straight Carapace Length (SCL) and Straight Carapace Width (SCW). Mass, where applicable, is indicated as mean (± standard deviation).*

	Ridley	*Flatback*
SCALES		
Nuchal	0 (1), 1 (11), 2 (7)	1 (2)
Central	6 (7), 7 (12)	5 (2)
Supracaudal	2 (19)	2 (2)
Costal L/R	6/6 (4), 6/7 (1), 7/6 (1), 7/7 (6), 7/8 (1), 8/7 (1), 8/8 (4), 9/9 (1)	4/4 (2)
Marginal L/R	12/12 (15), 12/13 (2), 13/13 (2)	11/11 (2)
Inframarginal	4/4 (19)	4/4 (2)
Postocular	3/3 (11), 3/4 (3), 4/3 (4), 4/4 (1)	3/3 (2)
Prefrontal	4 (12), 5 (5), 6 (2)	2 (2)
CARAPACE		
SCL (mm)	41.0 (± 1.9)	55.6 (± 2.8)
SCW (mm)	33.1 (± 1.7)	47.7 (± 6.4)
MASS (g)	15.3 (± 2.0)	10.1(dehydrated), 28.9
SAMPLE SIZE	19 (3 clutches)	2 (2 clutches)

The charred remains of three adult turtles were found beside a fire place at a camp-site on the eastern side of the island. On the southern point of the island an adult female Ridley was found dead on her back. The animal had tumbled over a ledge of beach rock as she returned to the sea. Having landed on her carapace she was unable to right herself and perished. Two Flatback hatchlings were found tangled in grass in the dunes. One had been air dried by dehydration, the other was alive but died soon after capture.

4. *Grant Island*

Grant Island has a well established eucalypt woodland and narrow beaches with little sand dune development. There was no visible evidence of goannas opening turtle nests. A total of 32 Ridley nests were located on the southern, western and northern beaches. Two hatched Flatback nests were located and verified by the empty shells of their characteristically large eggs.

5. *New Year Island*

New Year Island is the most northern island in the Northern Territory. It is a lone sand cay with a central lagoon containing mangroves. The common strand plant *Pemphis acidula* formed an inpenetrable thicket at the top of the shingle bank. The rising tide restricted this survey to the shingle banks of the southern and eastern sides of the island. A total of 38 recent Ridley nests were located on 500 m of beach. Four sets of hatchling tracks were observed but their nests could not be located amongst the shingle and *Pemphis*. There was neither evidence of Flatback nesting nor of egg predation by goannas.

Discussion

The survey revealed that Flatback and Ridley turtles nest in the Northern Territory during the winter months (June, July). NW Crocodile and Grant, support both species. Cape Wessel supports Ridley nesting and possibly Flatback, while New Year Island supports only Ridleys (Table 1). Further investigations into the possible relationship between distance from the coast, composition and texture of the beaches and the turtle species nesting in each locality seem promising.

Reports of nesting in late Summer (March-April) and winter (August) by Flatback and Ridley turtles at Cobourg Peninsula (Cogger & Lindner 1969) suggest a protracted nesting season in Northern Territory waters. Crab Island in the Gulf of Carpentaria, which has a similar latitude to the islands in this survey, has year-round nesting of Flatbacks with a peak in activity in August (Limpus *et al.* 1983).

Anthropological surveys indicate that it is not until the early dry season (May to July) that the aboriginal people of Arnhem Land start turtle egg collecting trips to the islands of the Arafura Sea. Apart from the collection of Flatback and Ridley eggs, those of the Green Turtle and Hawksbill Turtle *Eretmochelys imbricata* are harvested along with eggs of the Crested Tern (Davis 1985, 1989).

The mean clutch size obtained from the two hatched nests of Flatbacks (Table 2) is within one standard deviation (10.7) of the mean clutch size (50.2) reported for Mon Repos in south-eastern Queensland (Limpus 1971) and within the range for this species at Cobourg Peninsula (Cogger & Lindner 1969). The scale counts

of hatchlings (Table 3) agree with the modal counts for the respective scales of this species at Cobourg Peninsula (Cogger & Lindner 1969), Mon Repos (Limpus 1971) and Crab I (Limpus *et al.* 1983a).

Ridley turtles are seldom encountered in eastern Australia (Limpus 1975; Limpus *et al.* 1981; Limpus & Roper 1981; Limpus 1982) so the few observations presented here represent a significant addition to those already presented by Cogger & Lindner (1969). Clutch counts obtained from seven hatched or freshly laid nests ranged from 86 to 138 (Table 2), which falls within the range of 50 to 147 reported by Cogger & Lindner (1969) and Limpus *et al.* (1983a). The mean clutch size, egg diameter and egg mass from a sample of the three nests in this study are similar to those recorded for this species in the northern hemisphere (Hirth 1980) and other Australian Ridley populations (Cogger & Lindner 1969; Limpus *et al.* 1983a). The mean straight carapace length of hatchlings (Table 3) is similar to those recorded from Cobourg Peninsula (42 mm to 46 mm) (Cogger & Lindner 1969) and Gulf of Carpentaria (45 mm) (Limpus & Roper 1977) and the northern hemisphere (Hirth 1980).

Although no evidence of Hawksbill nesting was found, some of the supposed Ridley tracks may have belonged to this species as their tracks are similar in size and symmetry. It is hoped that further research into the preferred nesting seasonality and localities of the sea turtle species of the Northern Territory will be initiated by this survey.

Conservation

The Ridley turtle is exceedingly widespread in the tropical waters of the Pacific, Indian and South Atlantic Oceans (Pritchard 1977), but has received little scientific attention in Australian waters, due in part to its nesting being restricted to the islands of northern Australia. The islands of Arnhem Land are the major nesting areas of this species in Australian waters, yet in this remote and largely uninhabited part of Australia's coastline evidence of plastic and other nondegradable debris was all too obvious. The remains of fishing gear and general refuse along the beaches were clearly generated by maritime activities in the Arafura Sea and in no way an indictment of the aboriginal owners of the islands. The remains of a bituminous oil slick on Cape Wessel was a reminder of the proximity of the shipping lane to the north. The likely detrimental impacts of such pollution and debris on sea turtles are reviewed by Carr (1987). Although no evidence of death by contact with human waste was observed during the survey, the large amount of material washed onto the beaches is cause for concern. The transit of the survey crosses part of the northern prawn fishery. The mortality of turtles as incidental bycatch of the fishery was estimated to be low (Limpus (1982) and quantified at 6% of all turtles (mainly Flatback and Ridley) caught in nets (Poiner *et al.*1990).

The main threat to Ridley populations in the Northern Territory is the increase in human population pressure on the coastal resources (Cogger & Lindner 1969). Any conservation measures employed to protect Flatback nesting beaches will probably ensure the survival of the Ridley turtle as well (Cogger & Lindner 1969). It is now widely recognized that the thermal environment of the nest is an important component in turtle management strategies. The pivotal temperature, that which provides equal numbers of males and females in a clutch, has been

determined at 30° C for Ridley populations in Costa Rica (McCoy *et al.*1983). Significantly the major Ridley rookeries in this survey (Cape Wessel, Grant I and New Year I) had lower sand temperatures than those of N. W. Crocodile I where Flatback nests were more numerous (Table 1). Although nothing is known of the pivotal temperatures of Australian Ridley and Flatback populations, each island in the study may produce a different proportion of males and females for the species that nest there. It is hoped that the proposed tourist development of these islands (Julius 1990) proceed cautiously until more is known of these turtle species and their reproductive biology.

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